(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 009 140 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.06.2000 Bulletin 2000/24

(51) Int. Cl.[7]: **H04L 29/06**

(21) Application number: **99124627.3**

(22) Date of filing: **10.12.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **11.12.1998 JP 35331898**

(71) Applicant:
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
Kadoma-shi, Osaka 571-8501 (JP)

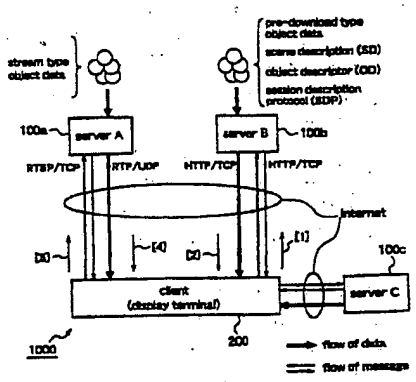
(72) Inventors:
- **Matsui, Yoshinori**
  Katano-shi, Osaka 576-0021 (JP)
- **Hagai, Makoto**
  Osaka-shi, Osaka 532-0022 (JP)

(74) Representative:
Eisenführ, Speiser & Partner
Martinistrasse 24
28195 Bremen (DE)

(54) Data transmission method, data transmission system, data receiving method, and data receiving apparatus

(57) A data transmission system comprises a data transmission apparatus for transmitting plural pieces of object data for reproducing plural objects constituting a scene, and a data receiving apparatus for receiving the plural pieces of object data and reproducing the scene on the basis of the object data. The data transmission apparatus comprises a first transmission unit for transmitting first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the first object data after the transmission of the first object data has been completed, and a second transmission unit for transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data. Therefore, the consumption of the transmission band of the network is minimized, and reliable image reproduction at the receiving end is assured regardless of transmission errors.

Fig.1



EP 1 009 140 A2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a data transmission method, a data transmission system, a data receiving method, and a data receiving apparatus and, more particularly, to a method for transmitting image data of MPEG4, through the Internet, according to a transmission mode adapted to the type of the image data.

BACKGROUND OF THE INVENTION

[0002] In recent years, we have greeted the age of multimedia in which audio, video, and other data are integrally handled, and the conventional information media, i.e., means for transmitting information to men, such as newspapers, magazines, televisions, radios, and telephones, have been adopted as the targets of multimedia. Generally, "multimedia" means media in which, not only characters, but also diagrams, speeches, and especially images are simultaneously expressed in relation with each other. In order to handle the conventional information media as the targets of multimedia, it is necessary to represent the data in digital formats.

[0003] When the quantity of data possessed by each of the above-described information media is estimated as the quantity of digital data, in the case of characters, the data quantity per character is only 1~2 byte. However, in the case of speech, the data quantity is 64kbits per second (quality for telecommunication). Further, in the case of moving picture, the required data quantity is more than 100Mbits per second (quality for current television broadcasting). So, in the above-described information media, it is not practical to handle such massive data as it is in the digital format. For example, although visual telephones have already been put to practical use by the ISDN (Integrated Services Digital Network) having a transmission rate of 64kbps~1.5Mbps, it is impossible to transmit an image from a television camera as it is by the ISDN.

[0004] So, data compression techniques are demanded. For example, for visual telephones, the moving picture compression techniques based on the H.261 and H.263 standards which have been standardized by ITU-T (International Telecommunication Union - Telecommunication Sector) are employed. Further, according to the data compression technique based on the MPEG1 standard, it is possible to record image data as well as audio data in an ordinary music CD (compact disk).

[0005] MPEG (Moving Picture Experts Group) is an international standard relating to a data compression technique for an image signal corresponding to a moving picture, and MPEG1 is the standard for compressing moving picture data to 1.5Mbps, i.e., data of a television signal to about 1/100. Since the transmission rate of the targets to which the MPEG1 standard is directed is limited to about 1.5Mbps, in MPEG2 which has been standardized to meet the demand for higher image quality, moving picture data is compressed to 2~15 Mbps.

[0006] Furthermore, under the existing circumstances, standardization of MPEG4 is now proceeded by the working group for standardization of MPEG1 and MPEG2 (ISO/IEC JTC1/SC29/WG11), and this MPEG4 enables coding and signal processing in object units, and thereby realizes new functions required in the age of multimedia.

[0007] Figures 7, and 8(a)-8(d) are diagrams for explaining the object-by-object coding process.

[0008] In MPEG4, an image G corresponding to one frame shown in figure 7 is treated as a composite image which is obtained by compositing plural objects. The image G is composed of a background B (figure 8(a)), a big fish F1 as a first foreground (figure 8(b)), a small fish F2 as a second foreground (figure 8 (c)), and a seaweed F3 as a third foreground (figure 8(d)).

[0009] Further, in the object-by-object coding process based on MPEG4, image data corresponding to the respective objects constituting the composite image G (the background B and the first to third foregrounds F1~F3) are encoded object by object. Then, coded image data (object data) corresponding to the respective objects are transmitted through a transmission medium.

[0010] On the other hand, in the object-by-object decoding process based on MPEG4, the coded image data corresponding to the respective objects are received object by object or in the multiplexed state, through the transmission medium. The received coded image data are decoded object by object, thereby generating decoded image data corresponding to each object. Then, the decoded image data corresponding to the respective objects are composited, thereby generating reproduced image data (scene data) corresponding to the composite image (decoded and reproduced image) G.

[0011] In the above-described process for transmitting the object-by-object coded image data, not only the coded image data (object data) obtained by coding the image data object by object but also control information are transmitted through the transmission medium. The control information includes, for example, scene description information which indicates the locations of the respective objects in one frame for compositing and displaying the objects, i.e., the display area of the composite image (refer to figure 15(b)).

[0012] Meanwhile, in recent years, a video distribution system has spread, in which the user can gain access to his/her favorite moving picture through a computer network.

[0013] Figure 9 is a schematic diagram for explaining such video distribution system.

[0014] In a video distribution system 700, a plurality of networks 701, 702 and 703 are connected to each other, and a plurality of servers 705, 706 and 707 which distribute video information are connected to the networks 701, 702 and 703, respectively.
Further, a plurality of video reception and reproduction terminal units (hereinafter referred to simply as "terminal units") which receive the distributed video information are connected to the respective networks 701~703. To simplify the description, only a terminal unit 704 connected to the network 701 is shown in figure 9.

[0015] In the video distribution system 700 so constructed, when the terminal unit 704 receives video information distributed from the server 705, initially, the terminal unit 704 contacts the server 705, and effectuates a circuit connection with the server 705. Thereafter, the terminal unit 704 receives coded image data distributed from the server 705, and reproduces the image data by decoding.

[0016] Hereinafter, a description will be given of a specific process of obtaining predetermined image data through the Internet as the above-described network.

[0017] As described above, a plurality of information sources (servers) are connected to the Internet which forms the network in the current information distribution system, and the respective information sources contain, for example, information of home pages relating to various subjects. Now it is assumed that the terminal unit 704 is connected to an information source having information of a home page HP the title of which is "World of Dinosaurs", and this home page HP is displayed on a display of the terminal unit 704.

[0018] In this home page HP, as shown in figure 10, items of video scenes relating to dinosaurs are represented by character strings "scene 1" ~ "scene 3", and the display areas of these character strings are designation areas D1~D3 for designating the moving pictures. In this state, the user moves the mouse pointer MP to the designation area D1 corresponding to the character string "scene 1" in the home page HP and clicks the mouse, an image MPs of a video scene P linked to the character string "scene 1" is displayed as shown in figure 11(a).

[0019] As a data transmission method for transmitting the image (text, audio, and video) data on the Internet, download type transmission and stream type transmission are currently employed.

[0020] In the download type transmission, a video file (image data) transmitted from a distribution server is once copied at the terminal and, thereafter, the image corresponding to the video file is reproduced. So, the terminal cannot start image reproduction until the file transmission is completed. That is, there is a latency time for transmission and, therefore, the download type transmission is not suitable for long-hours reproduction of video and audio. On the other hand, in the stream type transmission, while transmitting video data or the like from the distribution server to the terminal, image reproduction is carried out on the basis of the received data at the terminal end.

[0021] Therefore, data to be processed in real time, such as video data and audio data, are transmitted by the stream type transmission.

[0022] Recently, stream type transmission using a protocol called RTP (Real-time Transport Protocol) has been mainly employed. In a communication system in which a distribution server (transmitting end) S and a terminal (receiving end) T such as a personal computer are connected by a circuit such as ISDN in the Internet as shown in figure 16, transmission of image data is performed according to the RTP.

[0023] In the data transmission according to the RTP, processes for the respective packets are synchronized between the transmitting end and the receiving end by using time stamps as time information, and asynchronous (late arrival) packets and error packets in which transmission errors have occurred are discarded at the receiving end. Further, discarded or lost packets are detected at the receiving end, according to the absences of sequence numbers given to these packets.

[0024] Under the circumstances described above, in recent years, a method for transmitting image data of MPEG4 through the Internet has been examined.

[0025] In MPEG4, the video scene P shown in figure 11(a) is treated as a composite image G1 which is composed of four objects ob1, ob2, ob3, and ob4 (refer to figure 11(b)). That is, in this composite image G1, the object ob1 is a background as a still picture showing the sky or the like (figure 12(a)), the object ob2 is a first foreground as a cyclic moving picture showing a volcano (figure 12(b)), the object ob3 is a second foreground as a moving picture showing a big dinosaur (figure 12(c)), and the object ob4 is a third foreground as a moving picture showing a small dinosaur (figure 12(d)).

[0026] Hereinafter, a data transmission method based on MPEG4, which is currently examined, will be described by using figures 15(a) and 15(b). In the following description, a plurality of servers may be connected to the terminal T.

[0027] In this data transmission method, image data corresponding to one scene (composite image) treated in MPEG4 is obtained for each of plural objects constituting the scene, from a predetermined server, by the RTP, through the Internet.

[0028] Initially, as already described with respect to figure 10, in the state where the home page HP is displayed on the display unit of the terminal T, when the user cricks the mouse at the designation area D1 corresponding to the character string "scene 1 ", a session description protocol (SDP) (figure 13(a)) and an initial object descriptor (IOD) (figure 13(b)), which correspond to the scene (composite image) G1 and are linked to the character string "scene 1", are transmitted from the server S containing these data to the terminal T through the Internet (r fer to figure 9).

[0029] With reference to figure 13(a), in the SDP

[0014] In a video distribution system 700, a plurality of networks 701, 702 and 703 are connected to each other, and a plurality of servers 705, 706 and 707 which distribute video information are connected to the networks 701, 702 and 703, respectively.
Further, a plurality of video reception and reproduction terminal units (hereinafter referred to simply as "terminal units") which receive the distributed video information are connected to the respective networks 701~703. To simplify the description, only a terminal unit 704 connected to the network 701 is shown in figure 9.

[0015] In the video distribution system 700 so constructed, when the terminal unit 704 receives video information distributed from the server 705, initially, the terminal unit 704 contacts the server 705, and effectuates a circuit connection with the server 705. Thereafter, the terminal unit 704 receives coded image data distributed from the server 705, and reproduces the image data by decoding.

[0016] Hereinafter, a description will be given of a specific process of obtaining predetermined image data through the Internet as the above-described network.

[0017] As described above, a plurality of information sources (servers) are connected to the Internet which forms the network in the current information distribution system, and the respective information sources contain, for example, information of home pages relating to various subjects. Now it is assumed that the terminal unit 704 is connected to an information source having information of a home page HP the title of which is "World of Dinosaurs", and this home page HP is displayed on a display of the terminal unit 704.

[0018] In this home page HP, as shown in figure 10, items of video scenes relating to dinosaurs are represented by character strings "scene 1" ~ "scene 3", and the display areas of these character strings are designation areas D1~D3 for designating the moving pictures. In this state, the user moves the mouse pointer MP to the designation area D1 corresponding to the character string "scene 1" in the home page HP and clicks the mouse, an image MPs of a video scene P linked to the character string "scene 1" is displayed as shown in figure 11(a).

[0019] As a data transmission method for transmitting the image (text, audio, and video) data on the Internet, download type transmission and stream type transmission are currently employed.

[0020] In the download type transmission, a video file (image data) transmitted from a distribution server is once copied at the terminal and, thereafter, the image corresponding to the video file is reproduced. So, the terminal cannot start image reproduction until the file transmission is completed. That is, there is a latency time for transmission and, therefore, the download type transmission is not suitable for long-hours r production of video and audio. On the other hand, in the stream type transmission, while transmitting video data or the like from the distribution server to the terminal, image reproduction is carried out on the basis of the received data at the terminal end.

[0021] Therefore, data to be processed in real time, such as video data and audio data, are transmitted by the stream type transmission.

[0022] Recently, stream type transmission using a protocol called RTP (Real-time Transport Protocol) has been mainly employed. In a communication system in which a distribution server (transmitting end) S and a terminal (receiving end) T such as a personal computer are connected by a circuit such as ISDN in the Internet as shown in figure 16, transmission of image data is performed according to the RTP.

[0023] In the data transmission according to the RTP, processes for the respective packets are synchronized between the transmitting end and the receiving end by using time stamps as time information, and asynchronous (late arrival) packets and error packets in which transmission errors have occurred are discarded at the receiving end. Further, discarded or lost packets are detected at the receiving end, according to the absences of sequence numbers given to these packets.

[0024] Under the circumstances described above, in recent years, a method for transmitting image data of MPEG4 through the Internet has been examined.

[0025] In MPEG4, the video scene P shown in figure 11(a) is treated as a composite image G1 which is composed of four objects ob1, ob2, ob3, and ob4 (refer to figure 11(b)). That is, in this composite image G1, the object ob1 is a background as a still picture showing the sky or the like (figure 12(a)), the object ob2 is a first foreground as a cyclic moving picture showing a volcano (figure 12(b)), the object ob3 is a second foreground as a moving picture showing a big dinosaur (figure 12(c)), and the object ob4 is a third foreground as a moving picture showing a small dinosaur (figure 12(d)).

[0026] Hereinafter, a data transmission method based on MPEG4, which is currently examined, will be described by using figures 15(a) and 15(b). In the following description, a plurality of servers may be connected to the terminal T.

[0027] In this data transmission method, image data corresponding to one scene (composite image) treated in MPEG4 is obtained for each of plural objects constituting the scene, from a predetermined server, by the RTP, through the Internet.

[0028] Initially, as already described with respect to figure 10, in the state where the home page HP is displayed on the display unit of the terminal T, when the user cricks the mouse at the designation area D1 corresponding to the character string "scene 1 ", a session description protocol (SDP) (figure 13(a)) and an initial object descriptor (IOD) (figure 13(b)), which correspond to the scene (composite image) G1 and are linked to the character string "scene 1", are transmitted from the server S containing these data to the terminal T through the Internet (refer to figure 9).

[0029] With reference to figure 13(a), in the SDP

data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the first object data after the transmission of the first object data has been completed; and a second transmission process of transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided, and the consumption of the transmission band of the network is minimized.

[0044] According to a second aspect of the present invention, there is provided a data transmission method for transmitting scene data for reproducing a scene, from the transmitting end to the receiving end. This method comprises a first transmission process of transmitting first data which is a part of the scene data, in accordance with a first transmission protocol which does not necessarily perform retransmission against transmission errors; and a second transmission process of transmitting second data which is a part of the scene data, in accordance with a second transmission protocol which performs retransmission against transmission errors. The second data is scene description information and object relevant information, the scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers which are given to the respective objects for identifying these objects, and the object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects. Therefore, this method can prevent image reproduction at the receiving end from becoming unreliable due to transmission error, and the receiving end can perform reliable image reproduction even when some transmission error occurs.

[0045] According to a third aspect of the present invention, there is provided a data transmission method for transmitting scene data for reproducing a scene, from the transmitting end to the receiving end. This method comprises the steps of transmitting object data for reproducing plural objects constituting the scene, object by object, from the transmitting end to the receiving end; and transmitting table information from the transmitting end to the receiving end, the table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object. Therefore, the receiving end can associate each object with the location of object data corresponding to the object, on the basis of the table information.

[0046] According to a fourth aspect of the present invention, there is provided a data transmission system comprising a data transmission apparatus for transmitting plural pieces of object data for reproducing plural objects constituting a scene; and a data receiving apparatus for receiving the plural pieces of object data and reproducing the scene on the basis of the object data. The data transmission apparatus comprises a first transmission unit for transmitting first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the first object data after the transmission of the first object data has been completed; and a second transmission unit for transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided, and the consumption of the transmission band of the network is minimized.

[0047] According to a fifth aspect of the present invention, in the data transmission system of the fourth aspect, the data transmission apparatus transmits, by using the first transmission unit, control information for controlling transmission of the object data and reproduction of the objects, as initial data to be transmitted to the receiving end in the transmission process for data corresponding to one scene, the control information including transmission mode identification information indicating that the object data corresponding to each of the objects constituting one scene is to be transmitted by the first transmission unit or the second transmission unit. Therefore, in addition to the effect of minimizing the consumption of the transmission band of the network, this system can prevent image reproduction at the receiving end from becoming unreliable due to transmission error.

[0048] According to a sixth aspect of the present invention, there is provided a data transmission system comprising a data transmission apparatus for transmitting scene data for reproducing a scene; and a data receiving apparatus for receiving the scene data and reproducing the scene. The data transmission apparatus comprises a first transmission unit for transmitting first data which is a part of the scene data, in accordance with a first transmission protocol which does not necessarily perform retransmission against transmission errors; and a second transmission unit for transmitting second data which is a part of the scene data, in accordance with a second transmission protocol which performs retransmission against transmission errors. The second transmission unit transmits, as the second data, scene description information and object relevant information, the scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers which are given to the respective objects for identifying these objects, and the object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects. Therefore, this system can prevent image reproduction

data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end n the basis of the first object data after the transmission of the first object data has been completed; and a second transmission process of transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided, and the consumption of the transmission band of the network is minimized.

[0044] According to a second aspect of the present invention, there is provided a data transmission method for transmitting scene data for reproducing a scene, from the transmitting end to the receiving end. This method comprises a first transmission process of transmitting first data which is a part of the scene data, in accordance with a first transmission protocol which does not necessarily perform retransmission against transmission errors; and a second transmission process of transmitting second data which is a part of the scene data, in accordance with a second transmission protocol which performs retransmission against transmission errors. The second data is scene description information and object relevant information, the scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers which are given to the respective objects for identifying these objects, and the object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects. Therefore, this method can prevent image reproduction at the receiving end from becoming unreliable due to transmission error, and the receiving end can perform reliable image reproduction even when some transmission error occurs.

[0045] According to a third aspect of the present invention, there is provided a data transmission method for transmitting scene data for reproducing a scene, from the transmitting end to the receiving end. This method comprises the steps of transmitting object data for reproducing plural objects constituting the scene, object by object, from the transmitting end to the receiving end; and transmitting table information from the transmitting end to the receiving end, the table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object. Therefore, the receiving end can associate each object with the location of object data corresponding to the object, on the basis of the table information.

[0046] According to a fourth aspect of the present invention, there is provided a data transmission system comprising a data transmission apparatus for transmitting plural pieces of object data for reproducing plural objects constituting a scene; and a data receiving apparatus for receiving the plural pieces of object data and reproducing the scene on the basis of the object data. The data transmission apparatus comprises a first transmission unit for transmitting first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the first object data after the transmission of the first object data has been completed; and a second transmission unit for transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided, and the consumption of the transmission band of the network is minimized.

[0047] According to a fifth aspect of the present invention, in the data transmission system of the fourth aspect, the data transmission apparatus transmits, by using the first transmission unit, control information for controlling transmission of the object data and reproduction of the objects, as initial data to be transmitted to the receiving end in the transmission process for data corresponding to one scene, the control information including transmission mode identification information indicating that the object data corresponding to each of the objects constituting one scene is to be transmitted by the first transmission unit or the second transmission unit. Therefore, in addition to the effect of minimizing the consumption of the transmission band of the network, this system can prevent image reproduction at the receiving end from becoming unreliable due to transmission error.

[0048] According to a sixth aspect of the present invention, there is provided a data transmission system comprising a data transmission apparatus for transmitting scene data for reproducing a scene; and a data receiving apparatus for receiving the scene data and reproducing the scene. The data transmission apparatus comprises a first transmission unit for transmitting first data which is a part of the scene data, in accordance with a first transmission protocol which does not necessarily perform retransmission against transmission errors; and a second transmission unit for transmitting second data which is a part of the scene data, in accordance with a second transmission protocol which performs retransmission against transmission errors. The second transmission unit transmits, as the second data, scene description information and object relevant information, the scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers which are given to the respective objects for identifying these objects, and the object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects. Therefore, this system can prevent image reproduction

duction based on the second object data is performed in parallel with the reception of the second object data. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided.

[0056] According to a fourteenth aspect of the present invention, in the data receiving apparatus of the thirteenth aspect, control information for controlling transmission of the object data and reproduction of the objects is received by the first receiving unit, as initial data transmitted to the receiving end in the transmission process for data corresponding to the scene; and the object data corresponding to each object is received by one of the first and second receiving units, according to transmission mode identification information which is included in the control information and indicates that the object data is to be received by the first receiving unit or the second receiving unit. Therefore, in addition to the effect of minimizing the consumption of the transmission band of the network, this apparatus can prevent image reproduction at the receiving from becoming unreliable due to transmission error.

[0057] According to a fifteenth aspect of the present invention, there is provided a data receiving apparatus for receiving scene data for reproducing a scene, transmitted from the transmitting end, and reproducing the scene. This apparatus comprises a first receiving unit for receiving first data which is transmitted as a part of the scene data in accordance with a first transmission protocol that does not necessarily perform retransmission against transmission errors; a second receiving unit for receiving second data which is transmitted as a part of the scene data in accordance with a second transmission protocol that performs retransmission against transmission errors. The second receiving unit receives, as the second data, scene description information and object relevant information, the scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers corresponding to the respective objects, and the object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects. Therefore, this apparatus can prevent image reproduction at the receiving end from becoming unstable due to transmission error.

[0058] According to a sixteenth aspect of the present invention, there is provided a data receiving apparatus for receiving object data for reproducing objects constituting a scene, transmitted object by object from the transmitting end, and reproducing the scene. This apparatus comprises a first receiving unit for receiving first data which is transmitted as a part of the scene data in accordance with a first transmission protocol that does not necessarily perform retransmission against transmission errors; and a second receiving unit for receiving second data which is transmitted as a part of the scene data in accordance with a second transmission protocol that performs retransmission against transmission errors. The second receiving unit receives, as the second data, table information transmitted from the transmitting end, the table information associating an object identifier given to each object for identifying the object, with location informati n indicating the location of object data corresponding to the object. Therefore, even when some transmission error occurs, each object can be associated with the location of object data corresponding to the object on the basis of the table information.

[0059] According to a seventeenth aspect of the present invention, in the data receiving apparatus of the sixteenth aspect, the second receiving unit receives the table information as information included in control information for controlling transmission of object data corresponding to the respective objects and reproduction of the objects, the control information being received first as the scene data corresponding to one scene. Therefore, even when some transmission error occurs, each object can be associated with the location of object data corresponding to the object on the basis of the table information.

[0060] According to an eighteenth aspect of the present invention, in the data receiving apparatus of the sixteenth aspect, the second receiving unit receives the table information as information included in object relevant information transmitted from the transmitting end, the object relevant information indicating additional information relating to the respective objects, in association with object identifiers of the respective objects. Therefore, even when some transmission error occurs, each object can be associated with the location of object data corresponding to the object on the basis of the table information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061]

Figure 1 is a diagram for explaining a data transmission system according to a first embodiment of the present invention, illustrating the entire structure of the system.

Figure 2 is a diagram illustrating the contents of SDP information to be transmitted as control information in the data transmission system of the first embodiment.

Figure 3 is a diagram for explaining the relationships among the contents of SDP information, the contents of scene description (SD), and the reproduced scenes.

Figure 4 is a block diagram illustrating the constructions of a server (data transmission apparatus) and a client terminal (data receiving apparatus) in the data transmission system according to the first embodiment.

Figure 5 is a diagram for explaining the procedur of session setup in the data transmission system

duction based on the second object data is performed in parallel with the reception of the second object data. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided.

[0056] According to a fourteenth aspect of the present invention, in the data receiving apparatus of the thirteenth aspect, control information for controlling transmission of the object data and reproduction of the objects is received by the first receiving unit, as initial data transmitted to the receiving end in the transmission process for data corresponding to the scene; and the object data corresponding to each object is received by one of the first and second receiving units, according to transmission mode identification information which is included in the control information and indicates that the object data is to be received by the first receiving unit or the second receiving unit. Therefore, in addition to the effect of minimizing the consumption of the transmission band of the network, this apparatus can prevent image reproduction at the receiving from becoming unreliable due to transmission error.

[0057] According to a fifteenth aspect of the present invention, there is provided a data receiving apparatus for receiving scene data for reproducing a scene, transmitted from the transmitting end, and reproducing the scene. This apparatus comprises a first receiving unit for receiving first data which is transmitted as a part of the scene data in accordance with a first transmission protocol that does not necessarily perform retransmission against transmission errors; a second receiving unit for receiving second data which is transmitted as a part of the scene data in accordance with a second transmission protocol that performs retransmission against transmission errors. The second receiving unit receives, as the second data, scene description information and object relevant information, the scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers corresponding to the respective objects, and the object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects. Therefore, this apparatus can prevent image reproduction at the receiving end from becoming unstable due to transmission error.

[0058] According to a sixteenth aspect of the present invention, there is provided a data receiving apparatus for receiving object data for reproducing objects constituting a scene, transmitted object by object from the transmitting end, and reproducing the scene. This apparatus comprises a first receiving unit for receiving first data which is transmitted as a part of the scene data in accordance with a first transmission protocol that does not necessarily perform retransmission against transmission errors; and a second receiving unit for receiving second data which is transmitted as a part of the scene data in accordance with a second transmission protocol that performs retransmission against transmission errors. The second receiving unit receives, as the second data, table information transmitted from the transmitting end, th table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object. Therefore, even when some transmission error occurs, each object can be associated with the location of object data corresponding to the object on the basis of the table information.

[0059] According to a seventeenth aspect of the present invention, in the data receiving apparatus of the sixteenth aspect, the second receiving unit receives the table information as information included in control information for controlling transmission of object data corresponding to the respective objects and reproduction of the objects, the control information being received first as the scene data corresponding to one scene. Therefore, even when some transmission error occurs, each object can be associated with the location of object data corresponding to the object on the basis of the table information.

[0060] According to an eighteenth aspect of the present invention, in the data receiving apparatus of the sixteenth aspect, the second receiving unit receives the table information as information included in object relevant information transmitted from the transmitting end, the object relevant information indicating additional information relating to the respective objects, in association with object identifiers of the respective objects. Therefore, even when some transmission error occurs, each object can be associated with the location of object data corresponding to the object on the basis of the table information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061]

Figure 1 is a diagram for explaining a data transmission system according to a first embodiment of the present invention, illustrating the entire structure of the system.

Figure 2 is a diagram illustrating the contents of SDP information to be transmitted as control information in the data transmission system of the first embodiment.

Figure 3 is a diagram for explaining the relationships among the contents of SDP information, the contents of scene description (SD), and the reproduced scenes.

Figure 4 is a block diagram illustrating the constructions of a server (data transmission apparatus) and a client terminal (data receiving apparatus) in the data transmission system according to the first embodiment.

Figure 5 is a diagram for explaining the procedure of session setup in the data transmission system

mission of th data has been completed; and a str am type transmission process in which stream type object data amongst the object data is transmitted such that reproduction of information is performed at the receiving end during transmission of the stream type object data. The download type (hereinafter also referred to as pre-download type) object data is object data constituting a scene and having a relatively small quantity of data, and the stream type object data is object data constituting a scene and having a relatively large quantity of data.

[0070] This system 1000 includes first to third servers 100a, 100b, and 100c having predetermined data, and a client (display terminal) 200 which requests each server to send necessary data. These servers 100a~100c are connectable to the client 200 through the Internet. The first server (server A) 100a holds stream type video data, the second server (server B) 100b holds pre-download type video data, IOD information, and SDP information, and the third server (server C) 100c holds data of a predetermined home page. The video data are image data for reproducing objects constituting a scene. The IOD information includes SDS information which comprises scene descriptions SD1~SDn corresponding to predetermined times t1~tn in one scene, and ODS information which comprises object descriptors OD corresponding to all objects constituting one scene.

[0071] Further, in the SDP information held by the second server 100b, as shown in figure 2, initially, the URL of the IOD information and the transmission mode thereof are described in association with the data type (IOD). Thereafter, the URL of the ODS information and the transmission mode thereof are described in association with the data type (ODS) and, furthermore, the URL of the SDS information and the transmission mode thereof are described in association with the data type (SDS). The transmission modes of the IOD information, the ODS information, and the SDS information are download type.

[0072] Further, in the SDP information, the URL of each entity data and the transmission mode thereof are described in association with the data type (video, audio, or text) and, further, an identifier of the object descriptor corresponding to each entity data is described. With respect to the entity data corresponding to the object such as a background still picture, a cyclic moving picture, text, or audio, the transmission mode of the entity data is described as download type. With respect to the entity data corresponding to a normal moving picture, the transmission mode of the entity data is described as stream type. Figure 3 shows the specific contents of the SDP information. In figure 3, the specific descriptions of the data types are omitted.

[0073] In the SDP information, as shown in figures 2 and 3, the data type is described in the form of m = • • •, and the transmission mode and the URL are described in the form of a = • • •, following the data type (m = • • •), Further, the object identifier is described in the form of a = • • •, following the transmission mode and the URL (a = • • •). Table information which associates the object identifier for identifying one object with the URL indicating the location of object data corresponding to this object, is composed of the transmission mode and the URL (a = • • •) which follow one data type (m = • • •), and the object identifier (a = • • •) which follows the transmission mode and the URL (a = • • •)

[0074] Further, in the IOD information, as shown in figure 13(b), data of ODods (object descriptor) corresponding to the ODS information itself and data of ODsds (object descriptor) corresponding to the SDS information itself are described with the corresponding header information, respectively. Further, in the ODS information, as shown in figure 14(a), data of object descriptors (OD) corresponding to the respective objects constituting one scene are described together with the corresponding header information. Further, in the SDS information, as shown in figure 14(b), data of scene descriptions SD1~SDn indicating the scene construction of one scene corresponding to predetermined times t1~tn are described together with the corresponding header information.

[0075] Further, in the object descriptor (OD) of the object identifier (id=100), as shown in figure 15(a), ODid=100 as the value of the object identifier (id), and ESid=10 and ESid=20 as elementary stream identifiers (id) are described and, furthermore, an identifier "Video" which indicates that this object is video data (between video data and audio data), and additional information, for example, information for decoding coded entity data, are described. The contents of the object descriptors (OD) having other object identifiers are similar to that shown in figure 15(a). Further, the description of ODods (object descriptor) corresponding to the ODS information itself and the description of ODsds (object descriptor) corresponding to the SDS information itself are similar to that shown in figure 15(a).

[0076] Furthermore, in the scene description SD1, as shown in figure 15(b), the hierarchy of the objects constituting the scene at time t1 is described. The contents of the scene descriptions SD2~SDn at times t2~tn are similar to that shown in figure 15(b).

[0077] Next, the operation of the data transmission system will be described.

[0078] For example, in the state where the home page HP held by the third server 100c is displayed on the display unit of the client terminal 200 as shown in figure 10, when the user selects the character string "scene 1" in this home page HP by using a mouse pointer MP and clicks the mouse, a request for the SDP information corresponding to the scene 1 is output to the second server 100b which holds the SDP information linked to the character string "scene 1". Thereby, the SDP information is transmitted from the second server 100b to the client terminal 200.

[0079] Then, based on the cont nts of the SDP

mission of the data has been completed; and a stream type transmission process in which stream type object data amongst the object data is transmitted such that reproduction of information is performed at the receiving end during transmission of the stream type object data. The download type (hereinafter also referred to as pre-download type) object data is object data constituting a scene and having a relatively small quantity of data, and the stream type object data is object data constituting a scene and having a relatively large quantity of data.

[0070] This system 1000 includes first to third servers 100a, 100b, and 100c having predetermined data, and a client (display terminal) 200 which requests each server to send necessary data. These servers 100a~100c are connectable to the client 200 through the Internet. The first server (server A) 100a holds stream type video data, the second server (server B) 100b holds pre-download type video data, IOD information, and SDP information, and the third server (server C) 100c holds data of a predetermined home page. The video data are image data for reproducing objects constituting a scene. The IOD information includes SDS information which comprises scene descriptions SD1~SDn corresponding to predetermined times t1~tn in one scene, and ODS information which comprises object descriptors OD corresponding to all objects constituting one scene.

[0071] Further, in the SDP information held by the second server 100b, as shown in figure 2, initially, the URL of the IOD information and the transmission mode thereof are described in association with the data type (IOD). Thereafter, the URL of the ODS information and the transmission mode thereof are described in association with the data type (ODS) and, furthermore, the URL of the SDS information and the transmission mode thereof are described in association with the data type (SDS). The transmission modes of the IOD information, the ODS information, and the SDS information are download type.

[0072] Further, in the SDP information, the URL of each entity data and the transmission mode thereof are described in association with the data type (video, audio, or text) and, further, an identifier of the object descriptor corresponding to each entity data is described. With respect to the entity data corresponding to the object such as a background still picture, a cyclic moving picture, text, or audio, the transmission mode of the entity data is described as download type. With respect to the entity data corresponding to a normal moving picture, the transmission mode of the entity data is described as stream type. Figure 3 shows the specific contents of the SDP information. In figure 3, the specific descriptions of the data types are omitted.

[0073] In the SDP information, as shown in figures 2 and 3, the data type is described in the form of m = • • •, and the transmission mode and the URL are described in the form of a = • • •, following the data type (m = • • •). Further, the object identifier is described in the form of a = • • •, following the transmission mode and the URL (a = • • •). Table information which associates the object identifier for identifying one object with the URL indicating the location of object data corresponding to this object, is composed of the transmission mode and the URL (a = • • •) which follow one data type (m = • • •), and the object identifier (a = • • •) which follows the transmission mode and the URL (a = • • •)

[0074] Further, in the IOD information, as shown in figure 13(b), data of ODods (object descriptor) corresponding to the ODS information itself and data of ODsds (object descriptor) corresponding to the SDS information itself are described with the corresponding header information, respectively. Further, in the ODS information, as shown in figure 14(a), data of object descriptors (OD) corresponding to the respective objects constituting one scene are described together with the corresponding header information. Further, in the SDS information, as shown in figure 14(b), data of scene descriptions SD1~SDn indicating the scene construction of one scene corresponding to predetermined times t1~tn are described together with the corresponding header information.

[0075] Further, in the object descriptor (OD) of the object identifier (id=100), as shown in figure 15(a), ODid=100 as the value of the object identifier (id), and ESid=10 and ESid=20 as elementary stream identifiers (id) are described and, furthermore, an identifier "Video" which indicates that this object is video data (between video data and audio data), and additional information, for example, information for decoding coded entity data, are described. The contents of the object descriptors (OD) having other object identifiers are similar to that shown in figure 15(a). Further, the description of ODods (object descriptor) corresponding to the ODS information itself and the description of ODsds (object descriptor) corresponding to the SDS information itself are similar to that shown in figure 15(a).

[0076] Furthermore, in the scene description SD1, as shown in figure 15(b), the hierarchy of the objects constituting the scene at time t1 is described. The contents of the scene descriptions SD2~SDn at times t2~tn are similar to that shown in figure 15(b).

[0077] Next, the operation of the data transmission system will be described.

[0078] For example, in the state where the home page HP held by the third server 100c is displayed on the display unit of the client terminal 200 as shown in figure 10, when the user selects the character string "scene 1" in this home page HP by using a mouse pointer MP and clicks the mouse, a request for the SDP information corresponding to the scene 1 is output to the second server 100b which holds the SDP information linked to the character string "scene 1". Thereby, the SDP information is transmitted from the second server 100b to the client terminal 200.

[0079] Then, based on the contents of the SDP

exchange units 131 and 141. The HTTP header generation unit 132 generates an HTTP header corresponding to the read data. The HTTP data output unit 133 adds the HTTP header to the read data and outputs the data.

[0091] The server 100 further includes an RTP packet generation unit 142 and an RTP packet output unit 143. The RTP packet generation unit 142 generates an RTP packet corresponding to the read data, and gives the SSRC specified by the exchange unit 141 to the RTP packet. The RTP packet output unit 143 receives the RTP packet with the SSRC, and outputs the RTP packet in accordance with a port signal from the message exchange unit 141.

[0092] The client terminal 200 includes an HTTP data receiving unit 212 and an HTTP message exchange unit 211. The HTTP data receiving unit 212 receives the output from the HTTP data output unit 133 of the server 100, and outputs the URL of the entity data of each object and the object descriptor id thereof and, further, outputs the object descriptor OD. The HTTP message exchange unit 211 receives the output from the data receiving unit 212 (the URL of the entity data of the download type object), exchanges an HTTP message with the HTTP message exchange unit 131 of the server 100, and outputs the URL.

[0093] Further, the client terminal 200 includes an RTSP message exchange unit 213 and an RTP data receiving unit 214. The RTSP message exchange unit 213 receives the output from the HTTP data receiving unit 212 (the URL of the entity data of the stream type object) and the object descriptor id, exchanges an RTSP message with the RTSP message exchange unit 141 of the server 100, and outputs the RTP port number, the SSRC, and other data. The RTP data receiving unit 214 receives the RTP packet from the RTP packet output unit 143 of the server 100, and outputs the RTP data on the basis of the RTP port number, the SSRC, and other data which are output from the message exchange unit 213.

[0094] Further, the client terminal 200 includes a video decoding unit 220 and a video composition unit 230. The video decoding unit 220 decodes the coded image data (entity data) of each object on the basis of the output from the HTTP data receiving unit 212 and the output from the RTP receiving unit 214. The video composition unit 230 composites the decoded image data of the respective objects on the basis of the scene description information SD from the HTTP data receiving unit 212, and outputs reproduced image data corresponding to one scene to the display unit.

[0095] Next, a description will be given of the operations of the server 100 and the client terminal 200 during the data transmission process between the server 100 and the client terminal 200.

[0096] Figure 3 is a diagram showing the contents of the SDP information, the contents of the scene description information SD, and the relation of the scenes to be r produced, which are tr ated in the data transmission system. Figure 5 is a diagram for explaining the procedure of session set up in the data transmission system, i.e., the procedure to obtain imag data of the respective objects constituting one scene.

[0097] Hereinafter, a description will be given of the case where the client terminal 200 obtains the respective objects ob1–ob4 constituting the composite image G1 shown in figure 11(b), and reproduces and displays the composite image G1.

[0098] Accordingly, in figure 3, the SDP information indicates that the object ob1 having the object descriptor (id=100) is the background still picture in the composite image G1 shown in figure 11(b), and its entity data D_VO#1 is data stored in the server B, for which a transmission request is to be made according to the protocol (HTTP) corresponding to the download type transmission. Further, the SDP information indicates that the object ob2 having the object descriptor (id=200) is the cyclic moving picture (volcano) as the first foreground in the composite image G1 shown in figure 11(b), and its entity data D_VO#2 is data stored in the server B, for which a transmission request is to be made according to the protocol (HTTP) corresponding to the download type transmission. Further, the SDP information indicates that the objects ob3 and ob4 having the object descriptors (id=300,400) are the moving picture (big dinosaur) as the second foreground image and the moving picture (small dinosaur) as the third foreground image in the composite image G1 shown in figure 11(b), respectively, and their entity data S_VO#1 and S_VO#2 are data stored in the server A, for which transmission requests are to be made according to the protocol (RTP) corresponding to the stream type transmission.

[0099] Further, in figure 3, the scene description (SD) indicates the hierarchy of the objects constituting the scene G1. To be specific, assuming that the scene G1 corresponds to the first layer of the hierarchy, the object having the ODid of 100 and the object having the ODid of 200 belong to the layer lower than the first layer, i.e., the second layer, and the object having the ODid of 300 and the object having the ODid of 400 belong to the layer lower than the object (ODid=200) in the second layer, i.e., the third layer.

[0100] In the client terminal 200, when the user instructs the client terminal 200 to obtain the scene (composite image) G1 shown in figure 11(b), the HTTP message exchange unit 211 outputs a request for the SDP information, by specifying the URL of the SDP information, to the HTTP message exchange unit 131 of the server 100. Then, the exchange unit 131 of the server 100 transmits the URL of the SDP information to the data reading unit 120, and the data reading unit 120 reads the SDP information from the hard disk 110. The read SDP information is given a header which is generated in the HTTP header generation unit 132, and the SDP information with the head r is transmitted from the HTTP data output unit 133 to the client terminal 200.

exchange units 131 and 141. The HTTP header generation unit 132 generates an HTTP header corresponding to the read data. The HTTP data output unit 133 adds the HTTP header to the read data and outputs the data.

[0091] The server 100 further includes an RTP packet generation unit 142 and an RTP packet output unit 143. The RTP packet generation unit 142 generates an RTP packet corresponding to the read data, and gives the SSRC specified by the exchange unit 141 to the RTP packet. The RTP packet output unit 143 receives the RTP packet with the SSRC, and outputs the RTP packet in accordance with a port signal from the message exchange unit 141.

[0092] The client terminal 200 includes an HTTP data receiving unit 212 and an HTTP message exchange unit 211. The HTTP data receiving unit 212 receives the output from the HTTP data output unit 133 of the server 100, and outputs the URL of the entity data of each object and the object descriptor id thereof and, further, outputs the object descriptor OD. The HTTP message exchange unit 211 receives the output from the data receiving unit 212 (the URL of the entity data of the download type object), exchanges an HTTP message with the HTTP message exchange unit 131 of the server 100, and outputs the URL.

[0093] Further, the client terminal 200 includes an RTSP message exchange unit 213 and an RTP data receiving unit 214. The RTSP message exchange unit 213 receives the output from the HTTP data receiving unit 212 (the URL of the entity data of the stream type object) and the object descriptor id, exchanges an RTSP message with the RTSP message exchange unit 141 of the server 100, and outputs the RTP port number, the SSRC, and other data. The RTP data receiving unit 214 receives the RTP packet from the RTP packet output unit 143 of the server 100, and outputs the RTP data on the basis of the RTP port number, the SSRC, and other data which are output from the message exchange unit 213.

[0094] Further, the client terminal 200 includes a video decoding unit 220 and a video composition unit 230. The video decoding unit 220 decodes the coded image data (entity data) of each object on the basis of the output from the HTTP data receiving unit 212 and the output from the RTP receiving unit 214. The video composition unit 230 composites the decoded image data of the respective objects on the basis of the scene description information SD from the HTTP data receiving unit 212, and outputs reproduced image data corresponding to one scene to the display unit.

[0095] Next, a description will be given of the operations of the server 100 and the client terminal 200 during the data transmission process between the server 100 and the client terminal 200.

[0096] Figure 3 is a diagram showing the contents of the SDP information, the contents of the scene description information SD, and the relation of the scenes to be reproduced, which are treated in the data transmission system. Figure 5 is a diagram for explaining the procedure of session set up in the data transmission system, i.e., the procedure to obtain image data of the respective objects constituting one scene.

[0097] Hereinafter, a description will be given of the case where the client terminal 200 obtains the respective objects ob1~ob4 constituting the composite image G1 shown in figure 11(b), and reproduces and displays the composite image G1.

[0098] Accordingly, in figure 3, the SDP information indicates that the object ob1 having the object descriptor (id=100) is the background still picture in the composite image G1 shown in figure 11(b), and its entity data D_VO#1 is data stored in the server B, for which a transmission request is to be made according to the protocol (HTTP) corresponding to the download type transmission. Further, the SDP information indicates that the object ob2 having the object descriptor (id=200) is the cyclic moving picture (volcano) as the first foreground in the composite image G1 shown in figure 11(b), and its entity data D_VO#2 is data stored in the server B, for which a transmission request is to be made according to the protocol (HTTP) corresponding to the download type transmission. Further, the SDP information indicates that the objects ob3 and ob4 having the object descriptors (id=300,400) are the moving picture (big dinosaur) as the second foreground image and the moving picture (small dinosaur) as the third foreground image in the composite image G1 shown in figure 11(b), respectively, and their entity data S_VO#1 and S_VO#2 are data stored in the server A, for which transmission requests are to be made according to the protocol (RTP) corresponding to the stream type transmission.

[0099] Further, in figure 3, the scene description (SD) indicates the hierarchy of the objects constituting the scene G1. To be specific, assuming that the scene G1 corresponds to the first layer of the hierarchy, the object having the ODid of 100 and the object having the ODid of 200 belong to the layer lower than the first layer, i.e., the second layer, and the object having the ODid of 300 and the object having the ODid of 400 belong to the layer lower than the object (ODid=200) in the second layer, i.e., the third layer.

[0100] In the client terminal 200, when the user instructs the client terminal 200 to obtain the scene (composite image) G1 shown in figure 11(b), the HTTP message exchange unit 211 outputs a request for the SDP information, by specifying the URL of the SDP information, to the HTTP message exchange unit 131 of the server 100. Then, the exchange unit 131 of the server 100 transmits the URL of the SDP information to the data reading unit 120, and the data reading unit 120 reads the SDP information from the hard disk 110. The read SDP information is given a header which is generated in the HTTP header generation unit 132, and the SDP information with the header is transmitted from the HTTP data output unit 133 to the client terminal 200.

nal) for each stream type object is transmitted from the RTSP message exchange unit 213 at the client end to the RTSP message exchange unit 141 at the server end in accordance with the user's operation, the entity data of each stream type object is transmitted from the server to the client. The PLAY signals (reproduction start signals) for the respective stream type objects way be transmitted object by object, or in a lump.

[0115] That is, the data reading unit 120 reads the above-described entity data S_VO#1 and S_VO#2 from the hard disk 110, and the read entity data S_VO#1 and S_VO#2 are output from the data reading unit 120 to the RTP packet generation unit 142. In the RTP packet generation unit 142, the entity data S_VO#1 and S_VO#2 are packetized, and each RTP packet is given the SSRC as the channel id specified by the client. These RTP packets are output from the RTP packet generation unit 143 to the client end according to the RTP.

[0116] When the entity data S_VO#1 and S_VO#2 have been received by the RTP data receiving unit 214 at the client end, these entity data are successively taken from the packets on the basis of the port signal, the SSRC, and other additional information, and decoded by the video decoding unit 220, and thereafter, output to the video composition unit 230.

[0117] In the video composition unit 230, the download type entity data D_VO#1 and D_VO#2 and the stream type entity data S_VO#1 and S_VO#2 are composited according to the scene description information. Then, scene data corresponding to one scene is output to the display unit, and the scene is displayed.

[0118] As described above, according to the first embodiment of the present invention, amongst the image data (entity data) corresponding to the respective objects constituting one scene, the image data corresponding to the objects as a still picture and a cyclic moving picture are transmitted before reproduction of the scene data corresponding to one scene is started at the receiving end. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided, and the consumption of the transmission band of the network is minimized.

[0119] Further, the control information (SDP information) for performing transmission and reproduction of the image data corresponding to the respective objects includes the transmission mode identification information indicating whether the object data corresponding to each object should be transmitted by the download type transmission or the stream type transmission, and the SDP information is transmitted as the initial transmission data to the receiving end in the transmission process for the scene data corresponding to one scene, by the transmission mode using the highly reliable protocol, while the scene description information (SDS) and the object relevant information (ODS) are transmitted by the transmission mode using the highly reliable protocol. Therefore, reliable image reproduction at the receiving terminal is assured.

[0120] Further, when the scene data corresponding to one scene composed of plural objects is transmitted object by object from the transmitting end to the receiving end, th SDP information includes the table information which associates the object identifier given to each object for identifying the object with the URL corresponding to each object which indicated the location of the object data for reproduction and display of the object. Therefore, at the receiving end, each object can be associated with the URL of the corresponding object data, on the basis of the table information.

[0121] While in this first embodiment the ODS information (i.e., object descriptors OD of all objects) and the SDS information (scene descriptions SD1~SDn at times t1~tn) are obtained separately from the server, these information may be obtained as one file from the server.

[Embodiment 2]

[0122] Figure 6 is a diagram for explaining a data transmission system according to a second embodiment of the present invention, illustrating the procedure of session setup in this data transmission system.

[0123] In the system of this second embodiment, the above-described SDP information, IOD information, ODS information (object descriptors OD of all objects) and SDS information (scene descriptions SD1~SDn at times t1~tn) are stored together, as setup file information (MSF information) in a predetermined server.

[0124] In this second embodiment, for example, in the state where a home page HP held by a predetermined server is displayed on the display unit of the client terminal 200 as shown in figure 10, when the user selects the character string "scene 1" in the home page HP by the mouse pointer MP and clicks the mouse, a request for the MSF information corresponding to the scene 1 is output to the server which holds the MSF information linked with the character string "scene 1". Thereby, the MSF information is transmitted from the server to the client terminal 200. The transmission of the MSF information is performed by download type transmission according to HTTP (Hyper Test Transfer Protocol) based on TCP (Transport Control Protocol).

[0125] Then, based on the contents of the SDP information stored in the MSF information (refer to figure 2), the client terminal 200 starts the process of obtaining the IOD information and the entity data of the respective objects.

[0126] The subsequent transmission process is identical to that described for the first embodiment.

[0127] In the second embodiment so constructed, since the SDP information, the IOD information, the ODS information (object descriptors OD of all objects), and the SDS information (scene descriptions SD1~SDn at times t1~tn) are obtained together as setup file information (MSF information), the process of obtaining the control information is facilitated as compared with that

nal) for each stream type object is transmitted fr m the RTSP message exchange unit 213 at the client end to the RTSP message exchange unit 141 at the server end in accordance with the user's operation, the entity data of each stream type object is transmitted from the server to the client. The PLAY signals (reproduction start signals) for the respective stream type objects way be transmitted object by object, or in a lump.

[0115] That is, the data reading unit 120 reads the above-described entity data S_VO#1 and S_VO#2 from the hard disk 110, and the read entity data S_VO#1 and S_VO#2 are output from the data reading unit 120 to the RTP packet generation unit 142. In the RTP packet generation unit 142, the entity data S_VO#1 and S_VO#2 are packetized, and each RTP packet is given the SSRC as the channel id specified by the client. These RTP packets are output from the RTP packet generation unit 143 to the client end according to the RTP.

[0116] When the entity data S_VO#1 and S_VO#2 have been received by the RTP data receiving unit 214 at the client end, these entity data are successively taken from the packets on the basis of the port signal, the SSRC, and other additional information, and decoded by the video decoding unit 220, and thereafter, output to the video composition unit 230.

[0117] In the video composition unit 230, the download type entity data D_VO#1 and D_VO#2 and the stream type entity data S_VO#1 and S_VO#2 are composited according to the scene description information. Then, scene data corresponding to one scene is output to the display unit, and the scene is displayed.

[0118] As described above, according to the first embodiment of the present invention, amongst the image data (entity data) corresponding to the respective objects constituting one scene, the image data corresponding to the objects as a still picture and a cyclic moving picture are transmitted before reproduction of the scene data corresponding to one scene is started at the receiving end. Therefore, extreme increase in the data transmission quantity during scene reproduction is avoided, and the consumption of the transmission band of the network is minimized.

[0119] Further, the control information (SDP information) for performing transmission and reproduction of the image data corresponding to the respective objects includes the transmission mode identification information indicating whether the object data corresponding to each object should be transmitted by the download type transmission or the stream type transmission, and the SDP information is transmitted as the initial transmission data to the receiving end in the transmission process for the scene data corresponding to one scene, by the transmission mode using the highly reliable protocol, while the scene description information (SDS) and the object relevant information (ODS) are transmitted by the transmission mode using the highly reliable protocol. Therefore, reliable image reproduction at the receiving terminal is assured.

[0120] Further, when the scene data corresponding to one scene composed of plural objects is transmitted object by object from the transmitting end to the receiving end, the SDP information includes the table information which associates the object identifier given to each object for identifying the object with the URL corresponding to each object which indicated the location of the object data for reproduction and display of the object. Therefore, at the receiving end, each object can be associated with the URL of the corresponding object data, on the basis of the table information.

[0121] While in this first embodiment the ODS information (i.e., object descriptors OD of all objects) and the SDS information (scene descriptions SD1~SDn at times t1~tn) are obtained separately from the server, these information may be obtained as one file from the server.

[Embodiment 2]

[0122] Figure 6 is a diagram for explaining a data transmission system according to a second embodiment of the present invention, illustrating the procedure of session setup in this data transmission system.

[0123] In the system of this second embodiment, the above-described SDP information, IOD information, ODS information (object descriptors OD of all objects) and SDS information (scene descriptions SD1~SDn at times t1~tn) are stored together, as setup file information (MSF information) in a predetermined server.

[0124] In this second embodiment, for example, in the state where a home page HP held by a predetermined server is displayed on the display unit of the client terminal 200 as shown in figure 10, when the user selects the character string "scene 1" in the home page HP by the mouse pointer MP and clicks the mouse, a request for the MSF information corresponding to the scene 1 is output to the server which holds the MSF information linked with the character string "scene 1". Thereby, the MSF information is transmitted from the server to the client terminal 200. The transmission of the MSF information is performed by download type transmission according to HTTP (Hyper Test Transfer Protocol) based on TCP (Transport Control Protocol).

[0125] Then, based on the contents of the SDP information stored in the MSF information (refer to figure 2), the client terminal 200 starts the process of obtaining the IOD information and the entity data of the respective objects.

[0126] The subsequent transmission process is identical to that described for the first embodiment.

[0127] In the second embodiment so constructed, since the SDP information, the IOD information, the ODS information (object descriptors OD of all objects), and the SDS information (scene descriptions SD1~SDn at times t1~tn) are obtained tog ther as setup file information (MSF information), the process of obtaining the control information is facilitated as compared with that

and

transmitting table information from the transmitting end to the receiving end, said table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object.

4. A data transmission system comprising:

a data transmission apparatus for transmitting plural pieces of object data for reproducing plural objects constituting a scene; and
a data receiving apparatus for receiving the plural pieces of object data and reproducing the scene on the basis of the object data;
said data transmission apparatus comprising;

a first transmission unit for transmitting first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the first object data after the transmission of the first object data has been completed, and
a second transmission unit for transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data.

5. The data transmission system of Claim 4, wherein said data transmission apparatus transmits, by using the first transmission unit, control information for controlling transmission of the object data and reproduction of the objects, as initial data to be transmitted to the receiving end in the transmission process for data corresponding to one scene, said control information including transmission mode identification information indicating that the object data corresponding to each of the objects constituting one scene is to be transmitted by the first transmission unit or the second transmission unit.

6. A data transmission system comprising:

a data transmission apparatus for transmitting scene data for reproducing a scene; and
a data receiving apparatus for receiving the scene data and reproducing the scene;
said data transmission apparatus comprising;

a first transmission unit for transmitting first data which is a part of the scene data, in accordance with a first transmission protocol which does not necessarily perform retransmission against transmission errors, and
a second transmission unit for transmitting second data which is a part of the scene data, in accordance with a second transmission protocol which performs retransmission against transmission errors, and
said second transmission unit transmitting, as the second data, scene description information and object relevant information, said scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers which are given to the respective objects for identifying these objects, and said object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects.

7. A data transmission system comprising:

a data transmission apparatus for transmitting, object by object, object data for reproducing plural objects constituting a scene; and
a data receiving apparatus for receiving the object data and reproducing the scene on the basis of the object data; and
said data transmission apparatus comprising an information transmission unit for transmitting table information which associates an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object.

8. The data transmission system of Claim 7, wherein said information transmission unit transmits the table information in such a manner that the table information is included in control information for controlling transmission of the object data and reproduction of the objects, said control information being initial information to be transmitted to the receiving end in the transmission process for data corresponding to the scene.

9. The data transmission system of Claim 7, wherein said information transmission unit transmits the table information in such a manner that the table information is included in object relevant information which indicates additional information relating to the respective objects in association with object identifiers of the respective objects.

10. A data receiving method for receiving plural pieces of object data for reproducing plural objects constituting a scene, transmitted from the transmitting end, and reproducing th sc ne on the basis of the

and

transmitting table information from the transmitting end to the receiving end, said table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object.

4. A data transmission system comprising:

a data transmission apparatus for transmitting plural pieces of object data for reproducing plural objects constituting a scene; and
a data receiving apparatus for receiving the plural pieces of object data and reproducing the scene on the basis of the object data;
said data transmission apparatus comprising;

a first transmission unit for transmitting first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the first object data after the transmission of the first object data has been completed, and
a second transmission unit for transmitting second object data other than the first object data, amongst the plural pieces of object data, such that reproduction of the scene is performed at the receiving end on the basis of the second object data during the transmission of the second object data.

5. The data transmission system of Claim 4, wherein said data transmission apparatus transmits, by using the first transmission unit, control information for controlling transmission of the object data and reproduction of the objects, as initial data to be transmitted to the receiving end in the transmission process for data corresponding to one scene, said control information including transmission mode identification information indicating that the object data corresponding to each of the objects constituting one scene is to be transmitted by the first transmission unit or the second transmission unit.

6. A data transmission system comprising:

a data transmission apparatus for transmitting scene data for reproducing a scene; and
a data receiving apparatus for receiving the scene data and reproducing the scene;
said data transmission apparatus comprising;

a first transmission unit for transmitting first data which is a part of the scene data, in accordance with a first transmission protocol which does not necessarily perform retransmission against transmission errors, and
a second transmission unit for transmitting second data which is a part of the scene data, in accordance with a second transmission protocol which performs retransmission against transmission errors, and
said second transmission unit transmitting, as the second data, scene description information and object relevant information, said scene description information indicating the hierarchy of the respective objects constituting the scene, by object identifiers which are given to the respective objects for identifying these objects, and said object relevant information indicating additional information relating to the respective objects, in association with the object identifiers of the respective objects.

7. A data transmission system comprising:

a data transmission apparatus for transmitting, object by object, object data for reproducing plural objects constituting a scene; and
a data receiving apparatus for receiving the object data and reproducing the scene on the basis of the object data; and
said data transmission apparatus comprising an information transmission unit for transmitting table information which associates an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object.

8. The data transmission system of Claim 7, wherein said information transmission unit transmits the table information in such a manner that the table information is included in control information for controlling transmission of the object data and reproduction of the objects, said control information being initial information to be transmitted to the receiving end in the transmission process for data corresponding to the scene.

9. The data transmission system of Claim 7, wherein said information transmission unit transmits the table information in such a manner that the table information is included in object relevant information which indicates additional information relating to the respective objects in association with object identifiers of the respective objects.

10. A data receiving method for receiving plural pieces of object data for reproducing plural objects constituting a scene, transmitted from the transmitting end, and reproducing the scene on the basis of the

objects.

16. A data receiving apparatus for receiving object data for reproducing objects constituting a scene, transmitted object by object from the transmitting end, and reproducing the scene, said apparatus comprising:

a first receiving unit for receiving first data which is transmitted as a part of the scene data in accordance with a first transmission protocol that does not necessarily perform retransmission against transmission errors; and
a second receiving unit for receiving second data which is transmitted as a part of the scene data in accordance with a second transmission protocol that performs retransmission against transmission errors; and
said second receiving unit receiving, as the second data, table information transmitted from the transmitting end, said table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object.

17. The data receiving apparatus of Claim 16, wherein said second receiving unit receives the table information as information included in control information for controlling transmission of object data corresponding to the respective objects and reproduction of the objects, said control information being received first as the scene data corresponding to one scene.

18. The data receiving apparatus of Claim 16, wherein said second receiving unit receives the table information as information included in object relevant information transmitted from the transmitting end, said object relevant information indicating additional information relating to the respective objects, in association with object identifiers of the respective objects.

objects.

16. A data receiving apparatus for receiving object data for reproducing objects constituting a scene, transmitted object by object from the transmitting end, and reproducing the scene, said apparatus comprising:

a first receiving unit for receiving first data which is transmitted as a part of the scene data in accordance with a first transmission protocol that does not necessarily perform retransmission against transmission errors; and
a second receiving unit for receiving second data which is transmitted as a part of the scene data in accordance with a second transmission protocol that performs retransmission against transmission errors; and
said second receiving unit receiving, as the second data, table information transmitted from the transmitting end, said table information associating an object identifier given to each object for identifying the object, with location information indicating the location of object data corresponding to the object.

17. The data receiving apparatus of Claim 16, wherein said second receiving unit receives the table information as information included in control information for controlling transmission of object data corresponding to the respective objects and reproduction of the objects, said control information being received first as the scene data corresponding to one scene.

18. The data receiving apparatus of Claim 16, wherein said second receiving unit receives the table information as information included in object relevant information transmitted from the transmitting end, said object relevant information indicating additional information relating to the respective objects, in association with object identifiers of the respective objects.

Fig.2

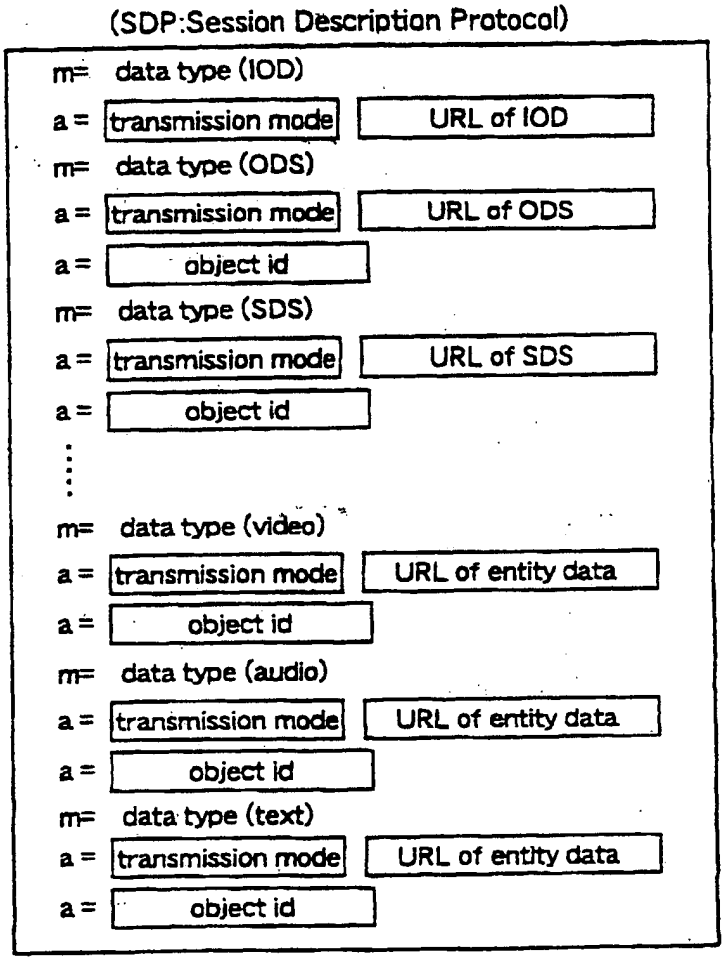

(SDP:Session Description Protocol)
m= data type (IOD)
a = transmission mode
URL of IOD
m= data type (ODS)
a = transmission mode
URL of ODS
a = object id
m= data type (SDS)
a = transmission mode
URL of SDS
a = object id
m= data type (video)
a = transmission mode
URL of entity data
a = object id
m= data type (audio)
a = transmission mode
URL of entity data
a = object id
m= data type (text)
a = transmission mode
URL of entity data
a = object id

Fig.2

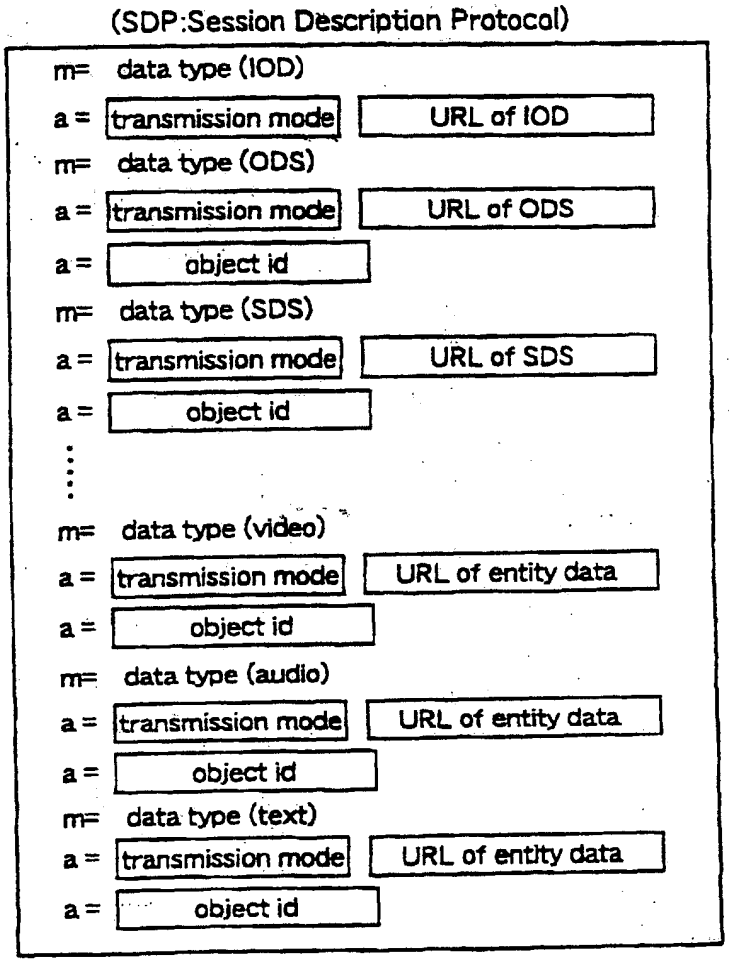

(SDP:Session Description Protocol)
m= data type (IOD)
a = transmission mode
URL of IOD
m= data type (ODS)
a = transmission mode
URL of ODS
a = object id
m= data type (SDS)
a = transmission mode
URL of SDS
a = object id
m= data type (video)
a = transmission mode
URL of entity data
a = object id
m= data type (audio)
a = transmission mode
URL of entity data
a = object id
m= data type (text)
a = transmission mode
URL of entity data
a = object id

Fig.4

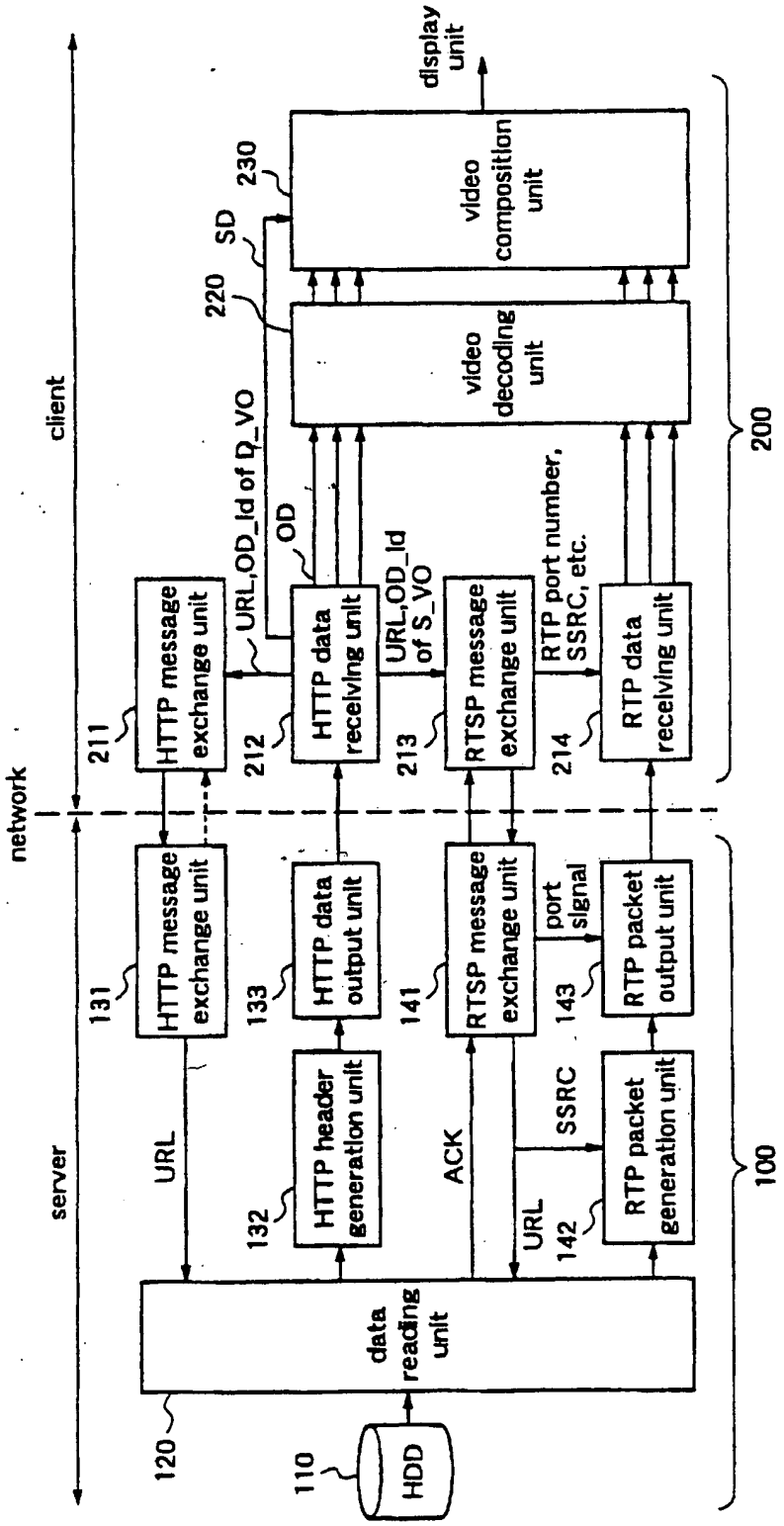

client
server
network
display unit
video composition unit
video decoding unit
HTTP message exchange unit
HTTP data receiving unit
RTSP message exchange unit
RTP data receiving unit
HTTP message exchange unit
HTTP data output unit
RTSP message exchange unit
RTP packet output unit
HTTP header generation unit
RTP packet generation unit
data reading unit
HDD
URL,OD_Id of D_VO
OD
URL,OD_Id of S_VO
RTP port number, SSRC, etc.
port signal
URL
ACK
SSRC
URL
SD
211
212
213
214
131
133
141
143
132
142
120
110
220
230
200
100

Fig.4

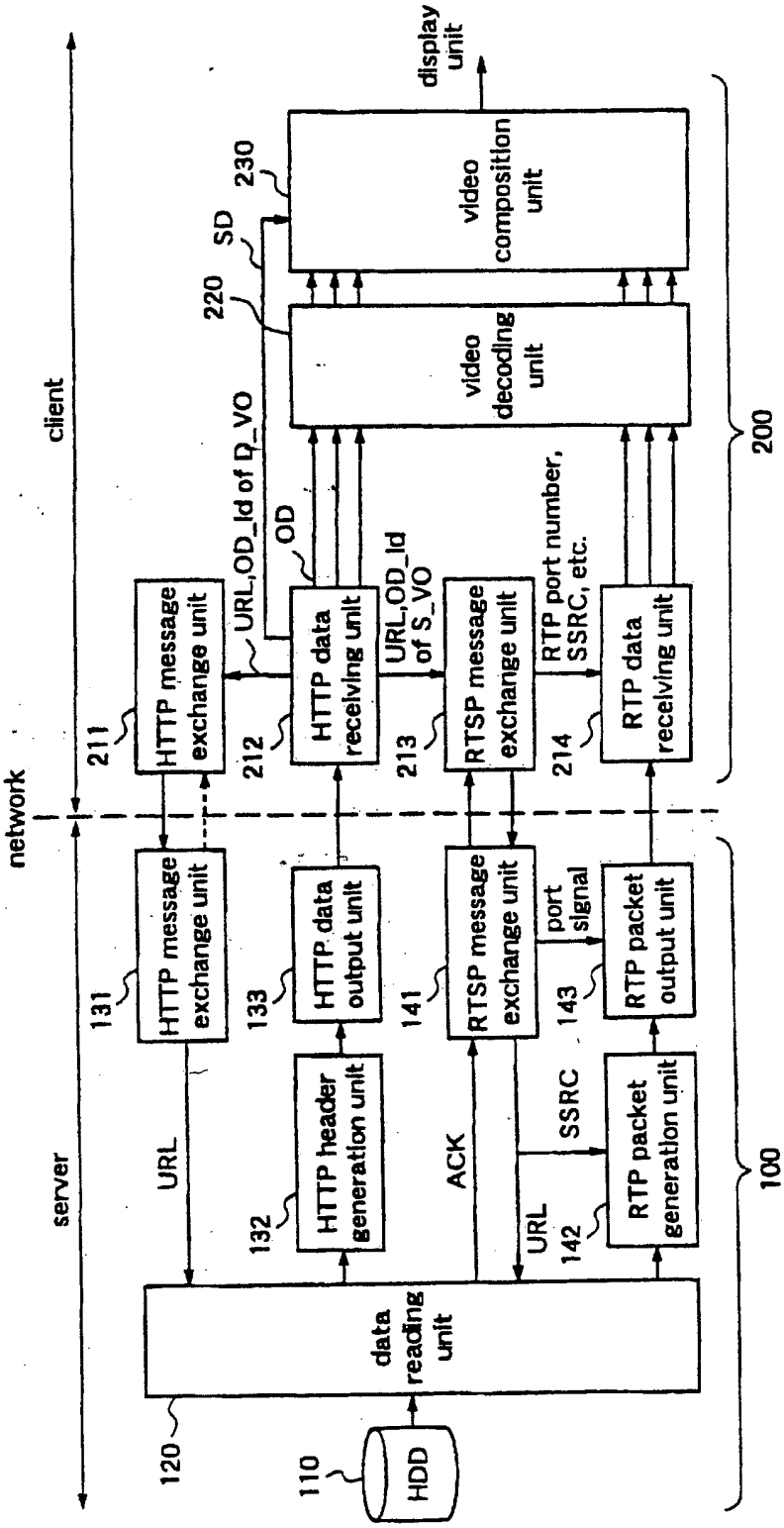

client
network
server
display unit
video composition unit
230
SD
220
video decoding unit
200
HTTP message exchange unit
211
URL,OD_Id of D_VO
OD
HTTP data receiving unit
212
URL,OD_Id of S_VO
RTSP message exchange unit
213
RTP port number, SSRC, etc.
RTP data receiving unit
214
HTTP message exchange unit
131
HTTP data output unit
133
RTSP message exchange unit
141
port signal
RTP packet output unit
143
HTTP header generation unit
132
ACK
SSRC
RTP packet generation unit
URL
142
URL
data reading unit
120
HDD
110
100

Fig.6

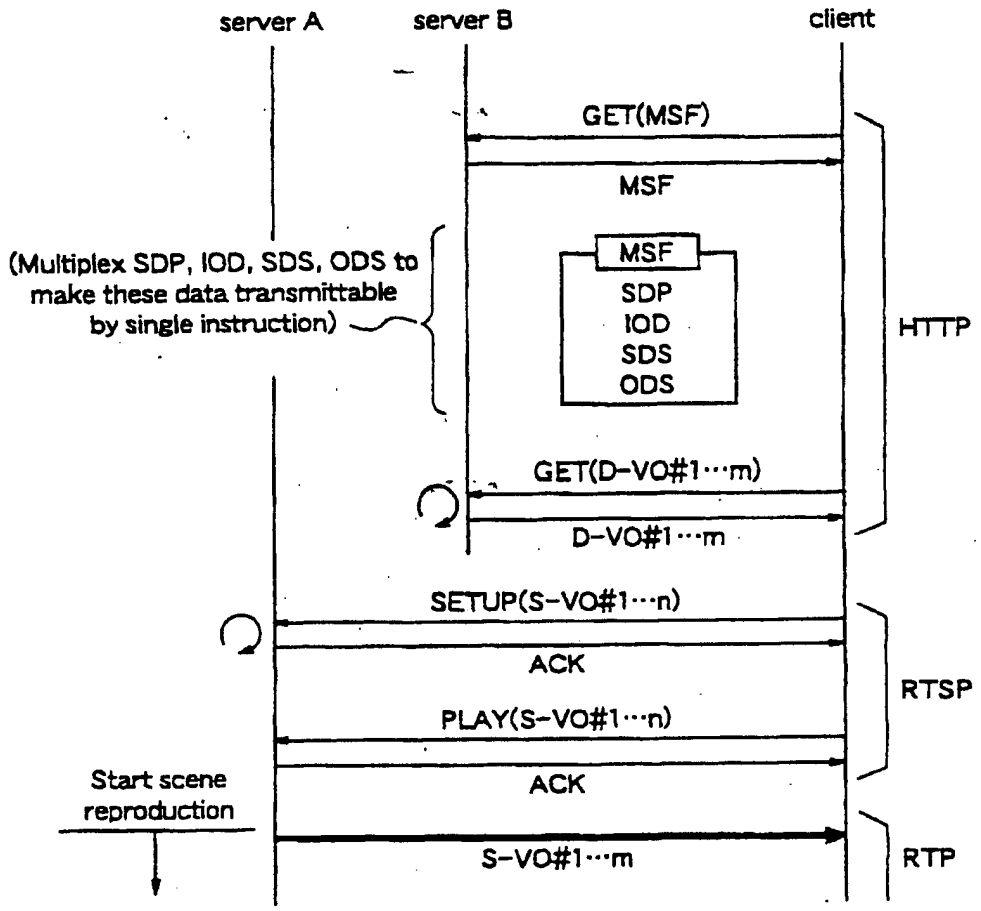
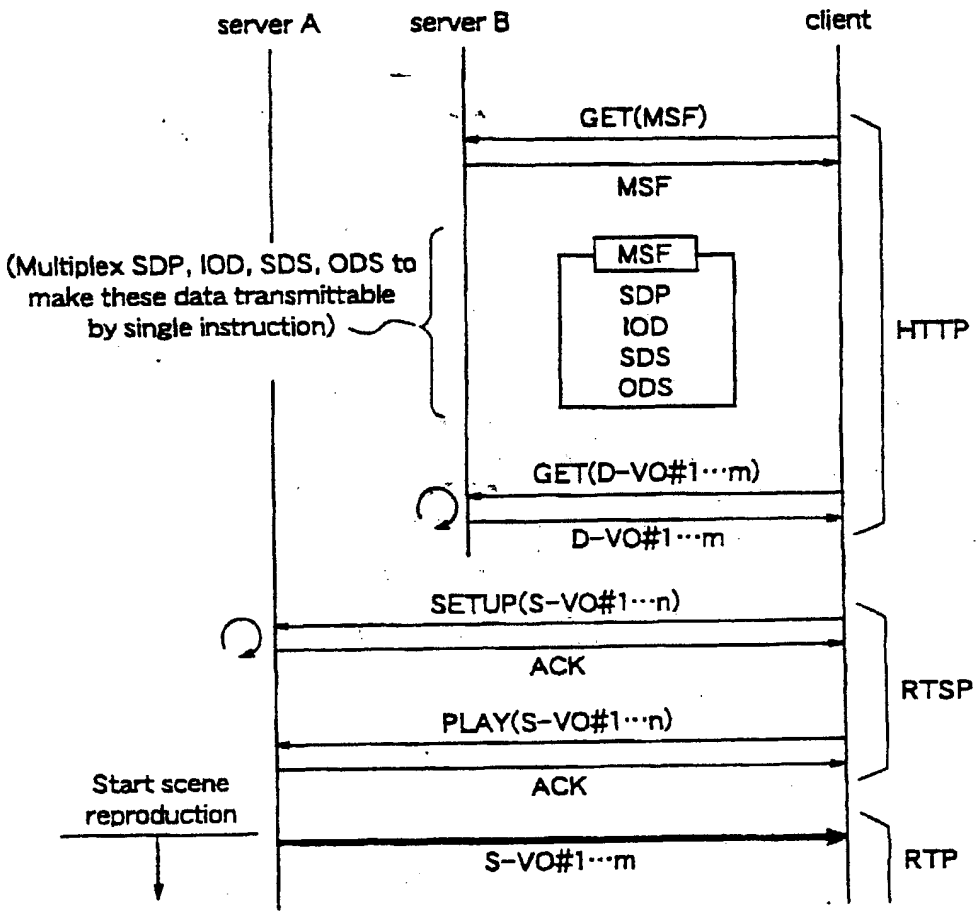

server A
server B
client
GET(MSF)
MSF
(Multiplex SDP, IOD, SDS, ODS to make these data transmittable by single instruction)
MSF
SDP
IOD
SDS
ODS
HTTP
GET(D-VO#1···m)
D-VO#1···m
SETUP(S-VO#1···n)
ACK
PLAY(S-VO#1···n)
ACK
RTSP
Start scene reproduction
S-VO#1···m
RTP

Fig.6


server A
server B
client
GET(MSF)
MSF
(Multiplex SDP, IOD, SDS, ODS to make these data transmittable by single instruction)
MSF
SDP
IOD
SDS
ODS
HTTP
GET(D-VO#1···m)
D-VO#1···m
SETUP(S-VO#1···n)
ACK
RTSP
PLAY(S-VO#1···n)
ACK
Start scene reproduction
S-VO#1···m
RTP

Prior Art

Fig.8 (a)

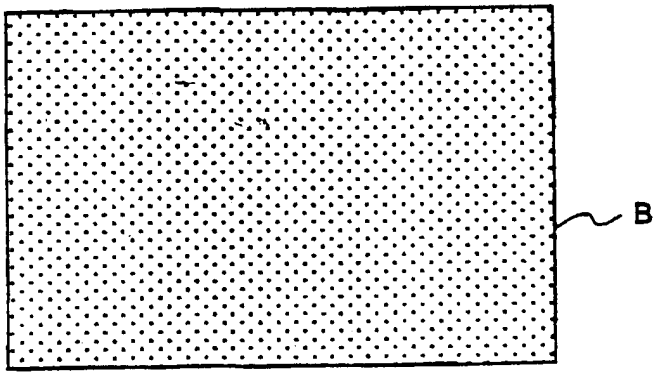


Fig.8 (b)

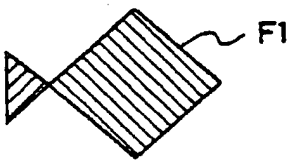
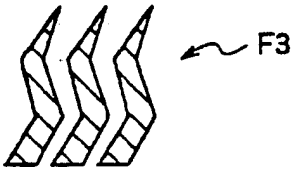


Fig.8 (c)

Fig.8 (d)



Prior Art

Fig.8 (a)

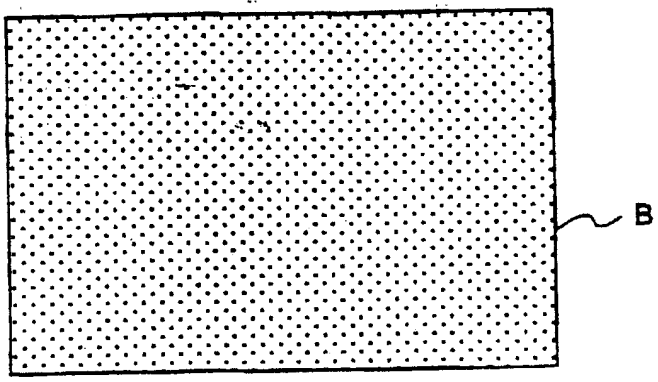


Fig.8 (b)

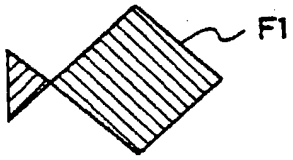
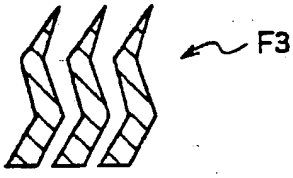


Fig.8 (c)

Fig.8 (d)



Prior Art

Fig.11 (a)

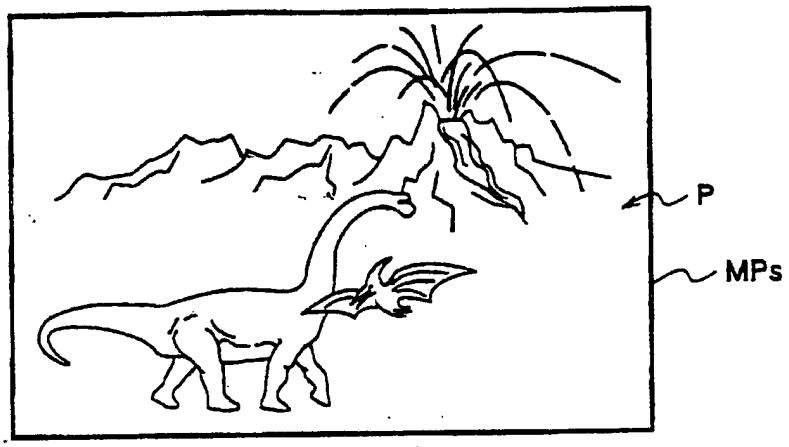
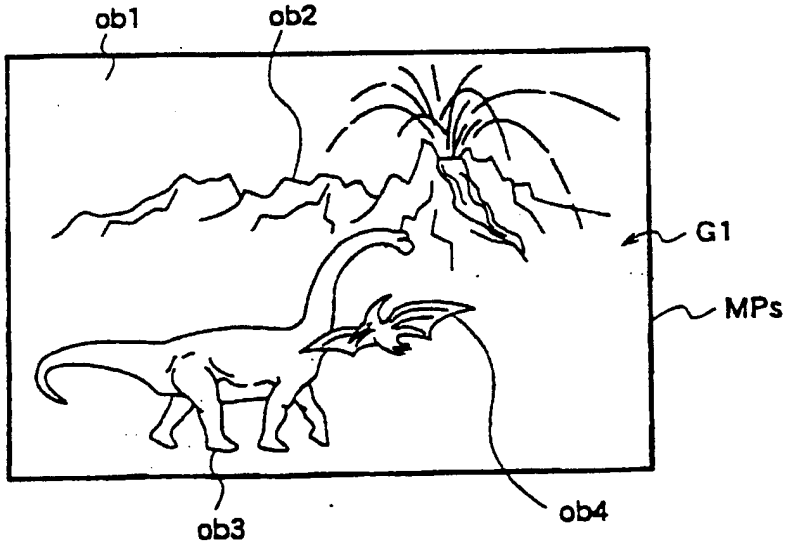


Fig.11 (b)



Prior Art

Fig.11 (a)

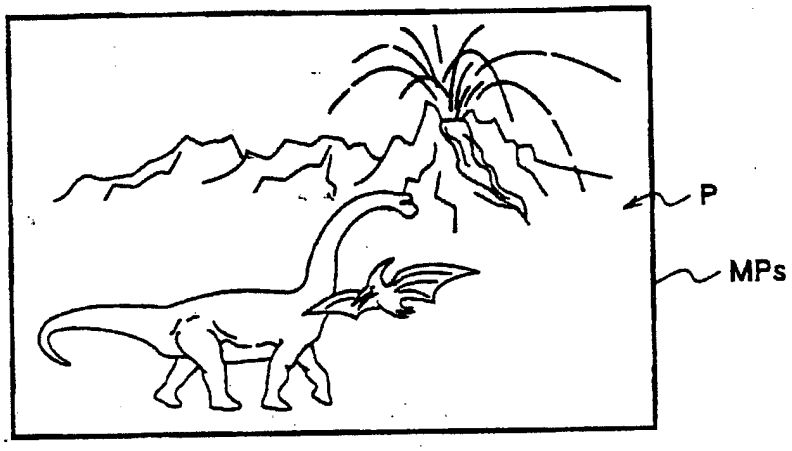
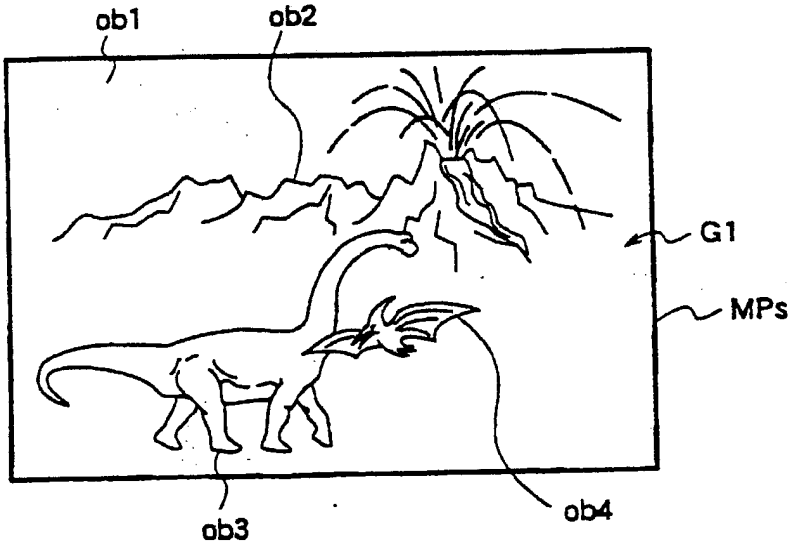


Fig.11 (b)



Prior Art

Fig.13 (a)

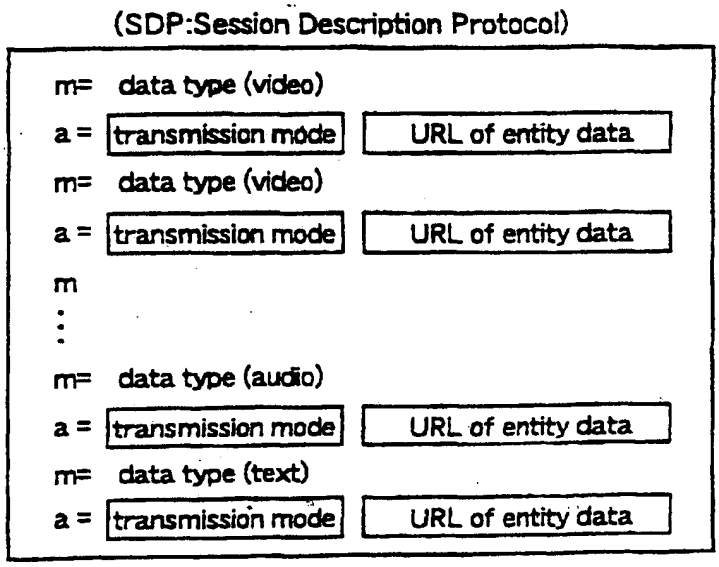
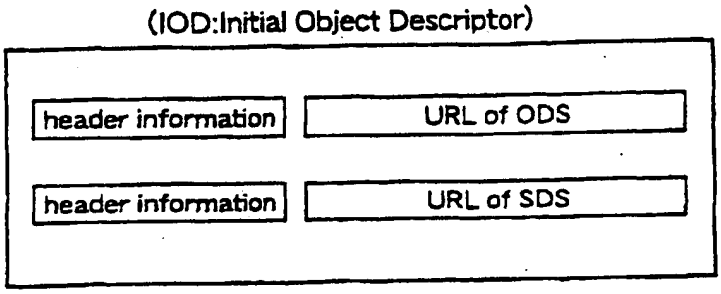


Fig.13 (b)



Prior Art

Fig.13 (a)

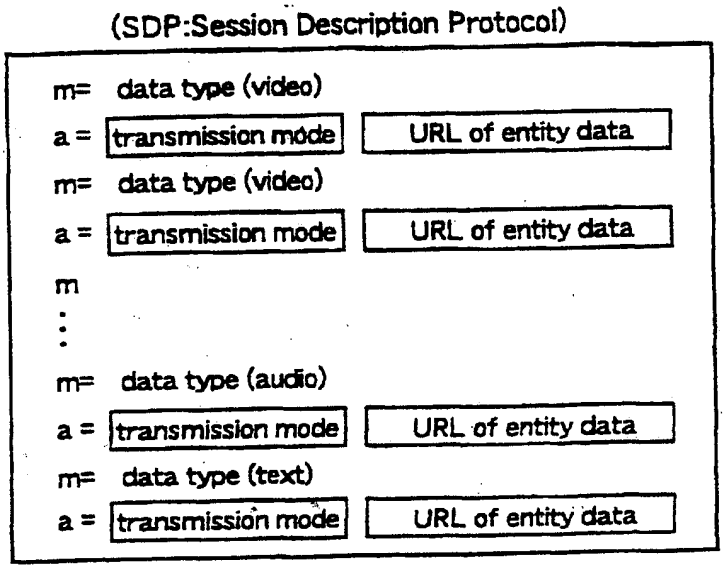
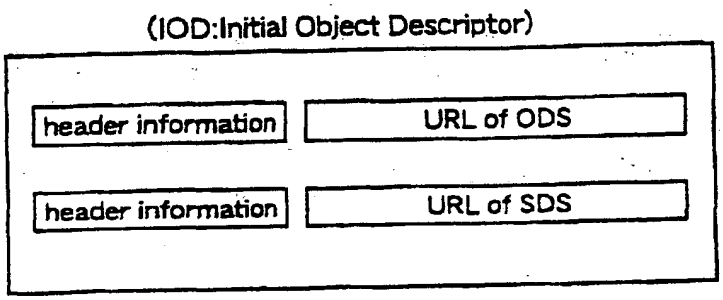


Fig.13 (b)



Prior Art

Fig.15 (a)

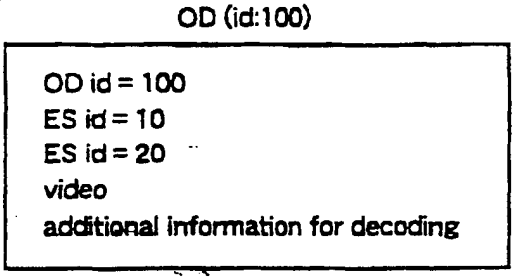


Fig.15 (b)

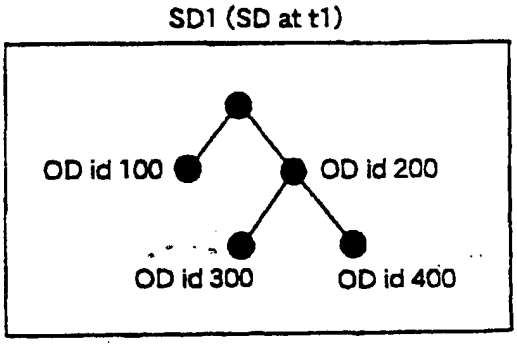


Fig.16 Prior Art

Prior Art

Fig.15 (a)

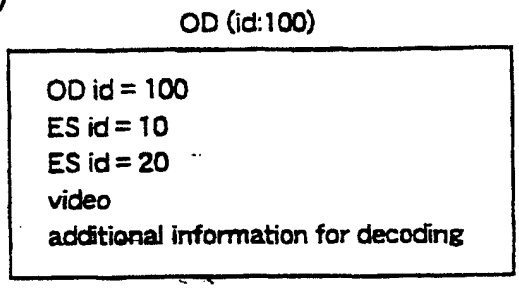


Fig.15 (b)

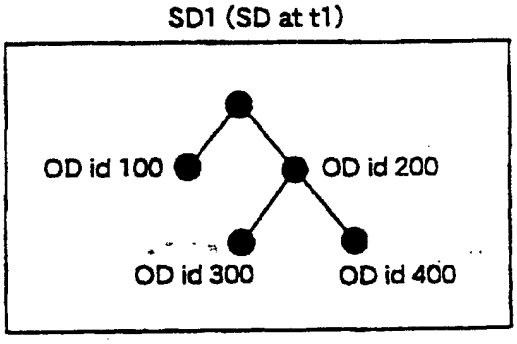


Fig.16 Prior Art